3.1.4.2 *ISUP Signaling with MF Signaling to the Home MSC*

When ISUP signaling is available throughout the call path except at the final trunk MF signal the switch interworking ISUP and MF signaling will need additional capabilities. The interworking switch must locate the destination switch using the CdPN in the incoming IAM. and then extract the dialed ported number and use it as the called party address in signaling th destination switch. A destination switch must recognize that it is the home switch of the dial ported number. It will terminate the call using the called party address.

3.1.4.3 *ISUP and MF Signaling Interworking*

Call paths that contain a mixture of ISUP and MF signaling are inefficient. After a switch obtains the LRN from the NP-SCP, for example, it formulates an IAM message. When the I/ arrives at an interworking switch that switch can only signal the dialed number to the next sw using MF signaling. The switch after the interworking switch may have to perform a redund NP query to determine how to route the call. A mixture of ISUP and MF signaling in the call path will require multiple LNP queries to route the call to the serving switch.

3.1.5 *WNP Trigger and Query Types*

Triggers and queries are tightly coupled with intelligent network architectures for the deployment of advanced services. Such architectures include the following:

- Intelligent Network (IN)
- Advanced Intelligent Network (AIN)
- Wireless Intelligent Network (WIN)

Each of these intelligent network architecture utilities specific query protocols and procedure terminology, and capability subsets. The WNP solution, however, recognizes that, prior to t implementation of any of these architecture, specialized trigger and query development may required. This document recognizes that WSPs will have different implementation needs an that various standards bodies (e.g., T1P1, TR45.2) have a challenge to arriving at the standar trigger and query message (e.g., prior to WIN definition). These qualifiers will become mor evident in the following subsections.

3.1.5.1 *Trigger Type*

Triggers expand basic call handling by allowing additional procedures to be defined and controlled by an external entity. The additional procedures are defined so that when certain conditions are met, the trigger is invoked. A common result of the trigger processing is initi a specific TCAP query to an external element for information or instructions on how to proc

A trigger must be defined and implemented in the MSC in order to launch the query to the N SCP for number portability. However, the trigger is not dependent on the introduction of an

specific intelligent network architecture. Thus, the WNP solution does not specify requiremer that any of the intelligent network architectures must be utilized or deployed, nor does it prohil the use of any. WSPs can implement what is appropriate to their network.

This trigger involves the determination of which calls result in NP queries. It will be a conditional trigger based upon 3 to 10 digits of the dialed number and will be administered at t MSC. If defined in relation to other non-WNP triggers, the trigger for WNP should generally the lowest priority of all of the dialed number triggers.

Services that involve persistent transactions[27] may be impacted with the implementation of WNP. A WNP trigger may be encountered in some persistent transactions. If the persistent transaction must be closed before an WNP query to the NP-SCP can be launched, these servic may not function properly.

3.1.5.2 *Query Type*

The WNP query is a TCAP message sent to the NP-SCP as initiated by the WNP trigger discussed above. Upon satisfying all of the trigger conditions, the MSC sends the query with the 10-digit DN. If the number is ported, the NP-SCP responds with an LRN for that DN. If t number is not ported, the NP-SCP typically responds with the DN.

Various intelligent network architectures offer different query message types for communicati between the switch and the database. Also, WSPs can choose to implement any of the protoc suitable to their networks and their chosen NP-SCP platform. WNP does not pose any requirements as to a specific query type.

The following is an overview of the options:

- *IN-based Protocol*: The switch initiates a "Instruction Start" message and awaits the "Control Connect" response. The IN based protocol is implemented in wireline portability and is anticipated to accommodate WNP without modifications.
- *AIN-based Protocol:* The switch initiates a "Info Analyzed" message and awaits the "Analyze Route" response. The query message indicates the CdPN as well as the Calling Party Number (CgPN) and bearer capability (e.g., the call type is voice). Though the latter two parameters are not required for portability, they are mandatory the "Info Analyzed" message.
- *WIN-based Protocol:* A WIN-based protocol could be defined for querying the NP-SCP. It would include the DN and would be capable of returning the LRN, at a minimum. WIN, however, is an intelligent architecture currently being defined. The

[27] A persistent transaction is an intelligent network process that is maintained after the initial message exchange. An examp might be the Auto Redial service which can be invoked after encountering a busy signal to monitor the busy line and rete call back when the line is available.

WNP query will be required in advance of WIN incorporation in standards. Therefore, the WNP query may or may not be WIN-based.

- *Other*: A message could be defined outside of the other three call models; for example, an IS-41 message might be defined. Also, a GSM message must be defined, and it may or may not fall within any of the above call models.

3.1.5.3 *Automatic Code Gap*

The MSCs are not typically equipped with Automatic Code Gap[28] (ACG) capabilities as they do not normally trigger an SCP (in today's wireless environment). However, NP-SCPs are required to support mechanisms to control overload situations via ACG. ACG Indicators parameter of TCAP indicates the cause for applying an ACG control, the time duration for the ACG control to be in effect and the time interval (gap) between ACG application Consequently, MSCs should recognize and react appropriately to such indications in the TCAP message from the NP-SCP.

As ACG is mainly being suggested so that a WSPs can query an SCP also serving a wireline provider and deployed in a wireline environment, the WNP Solution suggests that the ACG implemented for the wireless query be in line with the wireline ACG standards and requirements for Number Portability.

3.1.6 *Trigger Conditions*

The trigger should activate if the NPA-NXX of the CdPN matches an NPA-NXX open for portability within the region served by the MSC (as provisioned in the MSC NP routing tables).[29] A WSP might also, however, provision the MSC to activate the trigger based upon other conditions (e.g., interconnection agreements). An MSC need not perform a query if the Called Party Number is served by the MSC itself.

3.1.7 *Global Title Translation*

GTTs are used in the WNP environment, based on the DN, the MIN, and the IMSI. The following text describes some of the GTTs available. The need for new translation type assignments will be identified as part of the NP standards process. This section defines and categorizes the possible GTT uses in the WNP environment. It is not a specific request for new translation type assignments.

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[28] ACG is sometimes referred to as Automatic Call Gapping, however the TCAP standards terminology for the control is Automatic Code Gap.

[29] This condition rules out querying on operator services calls and N11 (e.g., 911 calls) as is appropriate.

3.1.7.1 *Number Portability Global Title Translation*

NP GTTs are 6-digit GTTs used to direct WNP query messages to the NP-SCP to obtain the LRN routing information. The SCCP Called Party Address (CdPA) of NP GTTs contains the first six digits of the dialed DN. The wireline industry is pursuing the idea of a separate TT value for each protocol versus one TT value for all three (i.e., AIN, IN, and WIN). Separate T values would allow the GTT function to provide a separate subsystem number (SSN) for each protocol. If just one TT value is used for all protocols, the NP-SCP must then determine the ty of protocol as part of TCAP processing.

3.1.7.2 *Mobile Station Identifier Global Title Translations*

MSID GTT messages, if identified, contain the MSID in SCCP CdPA. They are used to perfo GTT for MSID-based inter-network capabilities and services. Four GTTs are needed for MSI

- six digits of the MIN to locate the HLR
- six digits of the MIN to locate the Message Center
- six digits of the IMSI to locate the HLR
- six digits of the IMSI to locate the Message Center

3.1.7.3 *Mobile Directory Number Global Title Translations*

Most GTTs in the past have been based on the MIN. However, with the separation of the MSI and MDN, GTT based on MDN may be needed to achieve this past functionality. MDN GTT messages, if needed, contain the MDN in the CdPA. They are used to perform GTT for MDN based network capabilities and services. There are significant GTT impacts for MDN based activities that only provide the first six digits of the MDN in the CdPA. The impacts are beca the previously used six digit numbering schemes no longer provide sufficient addressing granularity in a number portability environment. When a customer ports to a new service provider, a 10-digit GTT entry is needed in each inter-network service GTT database so that queries are delivered to the appropriate network. In these cases, inter-network service GTT databases will have 10-digit GTT entries and 6-digit default entries. The 10-digit GTT entrie the GTT database are the numbers ported to a new service provider in the served portability a that require inter-network service. When a 10-digit GTT entry for a ported subscriber is not found, the 6-digit default GTT is interrogated to obtain the necessary routing information.

Two solutions are available to address service GTTs. The first modifies all query originating applications to provide ten digits in the CdPA for GTT. This solution is not preferred by the wireline industry due to the update expense of the originating offices. The second solution, called TCAP-GTT, is used when only six digits are available in the CdPA. TCAP-GTT perfo GTT by obtaining the MDN (or dialed digits) from the TCAP portion of the message. Note t this case requires a ten-digit MDN (or dialed digits) in the TCAP portion of the message. In most cases, this information is available. Normal SCCP error procedures should be invoked the GTT fails, even if the failure occurred during TCAP interrogation.

3.1.7.4 Wireline Service Global Title Translations

Wireline Service GTTs for services sent to or received from wireline networks may be needed wireless networks. These GTTs require 10-digit translation in order to determine the appropri destination where the query is to be sent. Impacts to these GTT database are the same as described in Section 3.1.7.3 above.

3.1.8 Home Location Register and Authentication Center

The Home Location Register (HLR) is a standard function of wireless signaling and mobility management. The WNP solution presumes the HLR to serve the same function. The HLR hol the subscriber profile which should be capable of separating and mapping the MDN to the MSID.

The Authentication Center is also a standard function in wireless telecommunications. The separation of the MSID and the MDN may impact the AC and its associated authentication formulas; the signaling between the HLR and the AC, however, is not likely to be impacted by WNP

3.1.8.1 Directory Number to HLR Mapping

When a Location Request message is routed to the home network, the network must route the Location Request message to the subscriber's HLR. Some networks have stand-alone HLRs separate from the MSC; some networks have multiple HLRs.

HLR subscriber profiles are typically arranged and indexed by MSID. However, the home network may only have the subscriber's MDN to use for routing the Location Request messag to the HLR serving the subscriber. Service providers that employ stand-alone HLRs or have multiple HLRs supported an MSC need to ensure that the Location Request message is routed the correct HLR for the subscriber. This scenario is further complicated if a WSP deploys an MSC gateway architecture.

Service providers can implement a Location Request routing method that is effective in their internal network.

3.1.9 Abnormal Procedures

A number of situations exists where a call requires WNP processing but a failure prevents the switch from receiving an LRN for routing the call. Such instances include

- signaling link failure,
- NP-SCP outage or overload,
- WNP query timer expire, or

- incorrect STP translation.

Regardless of the cause, the MSC should route the call as if the dialed directory number were not in an open portable block. Specifically, the FCI bit in the IAM message should not be set and the CdPN parameter should contain the dialed DN.

This procedure of routing the call as if it were not ported is called "default routing" and ensures that additional attempts will be made to complete the call. With default routing, a chance exists that the call might route to the donor network. The donor network should attempt to perform the query and re-route the call to the correct service provider.

3.2 Call Flows

The call flows in this section are included to illustrate the inter-workings of the above network architecture. They are based on IS-41 but are not meant to preclude GSM based protocols. The messages are meant to convey the required function and are not necessarily the actual messages defined in the protocol. Furthermore, the call flows do not represent all the information that is conveyed in each instance, only that pertinent to number portability. The call flows are based on normal procedures and do not include error conditions.

3.2.1 Registration and Authentication

Because of the separation of the MDN and the MSID, the process of registration and authentication remains unchanged in WNP. Therefore, no call flow for registration and authentication has been included.

The information exchange, however, is impacted. When the mobile registers, it will pass the MSID Upon receiving an MSID in the registration notification message, the HLR shall include the MDN of the mobile subscriber in the registration notification response message. This will provide the MDN to the Serving MSC/VLR for subsequent call processing.

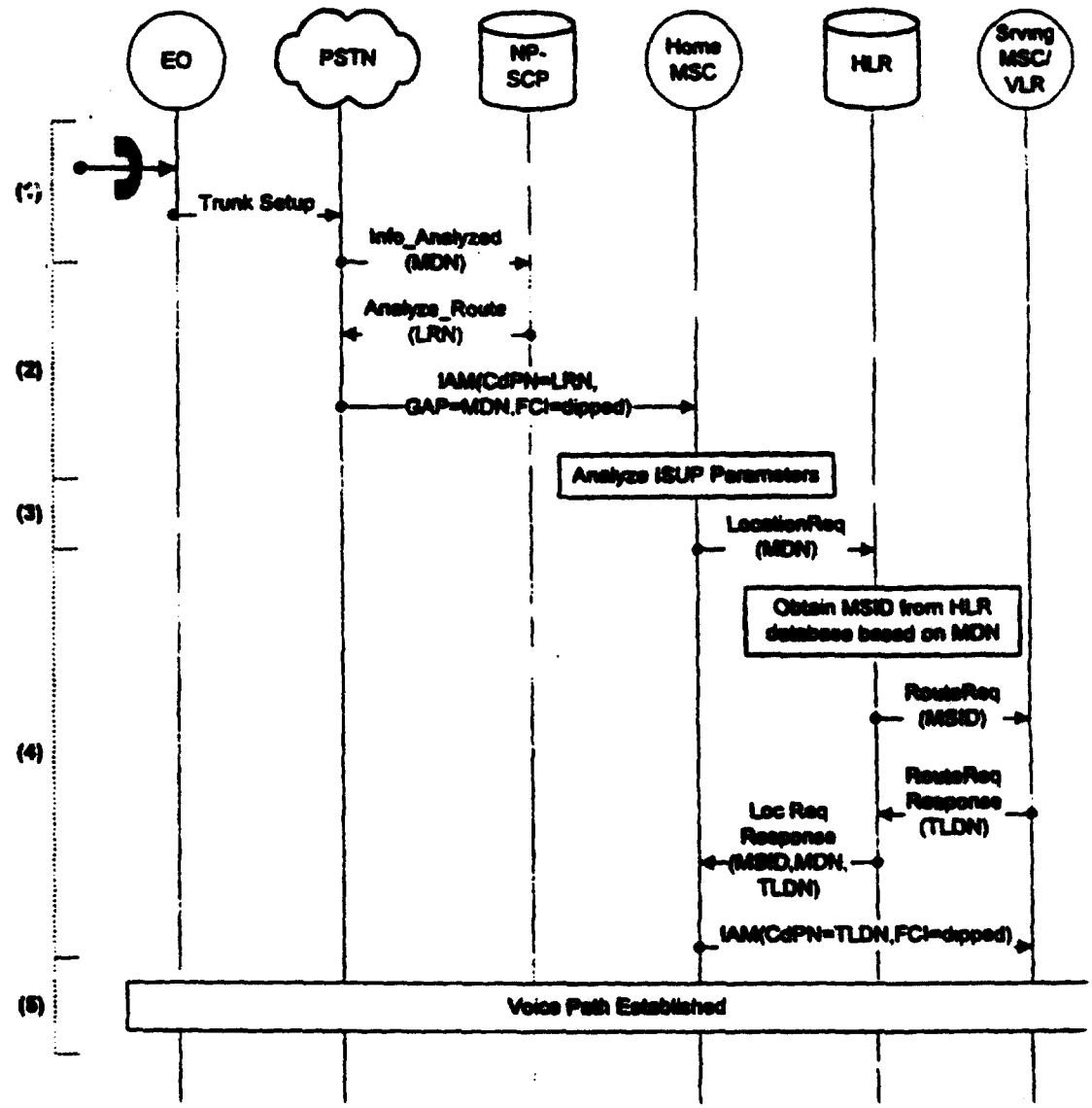
3.2.2 Call Routing To a Ported Directory Number

Wireless call routing can be divided into three scenarios: Land-to-Mobile, Mobile-to-Land, and Mobile-to-Mobile.

3.2.2.1 The Landline-to-Mobile Call

Figure 3-2 illustrates a landline call to a ported mobile subscriber. Text follows the figure for a explanation of each step.

Figure 3-2 Landline to Mobile Call Flow



Associated Call Flow Description:

(1) A landline phone originates a call.

(2) A landline switch queries the NP-SCP, obtains the LRN for the ported MDN, and use the LRN to route to the Home MSC.

(3) Upon receipt of the IAM message, the MSC performs the following analysis:

(a) It confirms that the CdPN belongs to its own network.

(b) It checks the FCI mth bit for the NP-SCP dip indication. If the mth bit is not set, then the call flow skips to step 4. If the mth bit is set, but no GAP is included, the call flow skips to step 4. If the mth bit is set and the GAP is included, the MSC uses the value in the GAP parameter as the CdPN.

(4) The MSC now attempts to locate and deliver the call to the mobile using existing call delivery procedures with the following highlights:

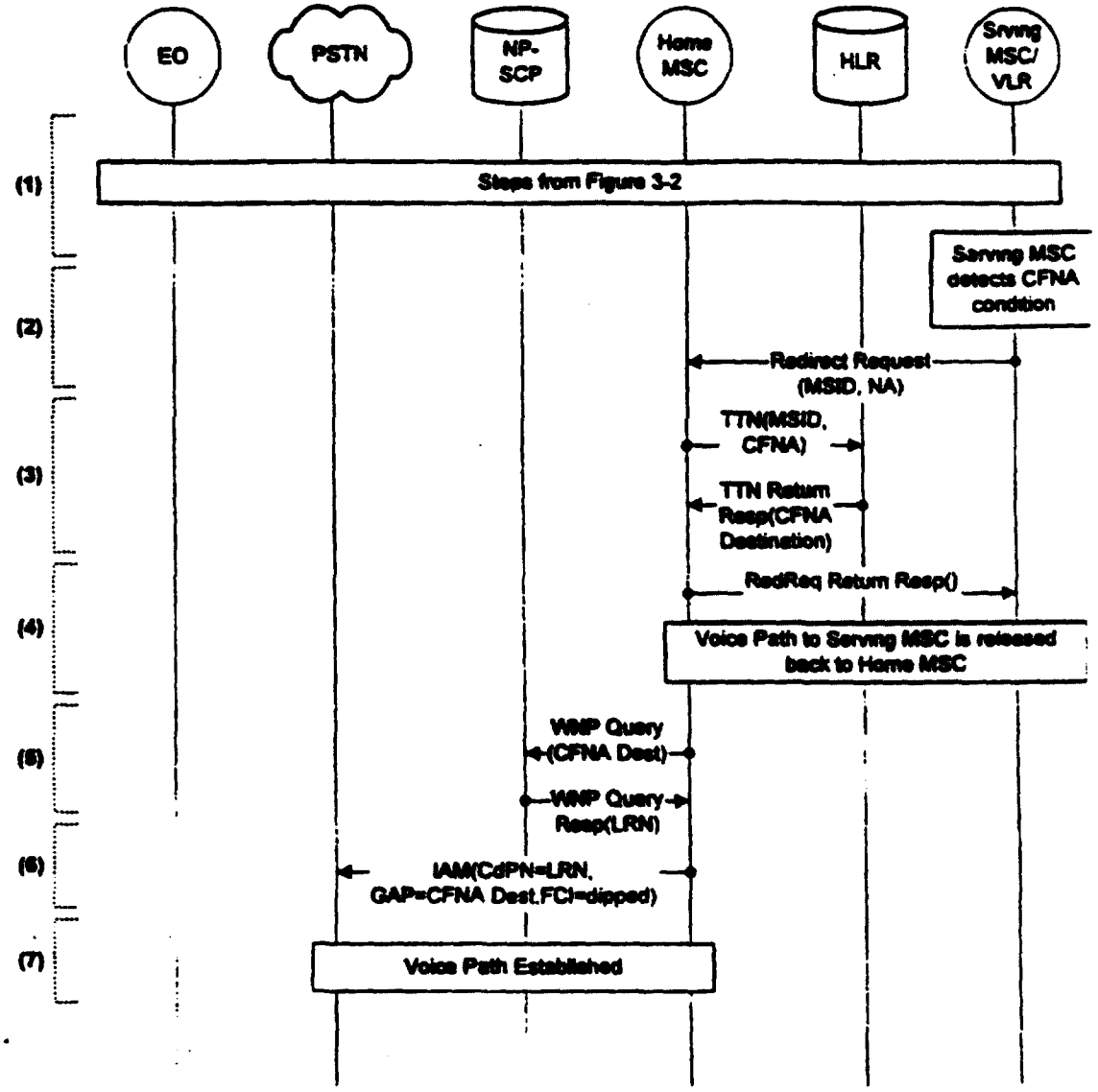
- The Location Request Return Result should include the MSID.
- The final trunk setup IAM message should ensure that a query is not necessary on a TLDN by setting the FCI query indicator.
- If the MSC cannot distinguish between TLDN digits and Call Forwarding digits, the MSC, in attempting to route out the call, may activate the WNP trigger and unnecessarily query the NP-SCP. This document recommends that IS-41 provide the means to indicate type of digits so that, at a minimum, the MSC can know to set FCI bit as appropriate so that an unnecessary dip does not occur in the PSTN during final trunk setup.

(5) The mobile station answers the call and the voice path is established.

3.2.2.2 *The Landline-to-Mobile Call with Call Forwarding interaction*

Figure 3-3 illustrates a landline call to a ported mobile subscriber. This call flow, however, depicts the subsequent leg of the call when the call is forwarded, for example, to a voice mail system. Specifically, this call flow illustrates only one example of redirection, Call Forwarding No Answer (CFNA). Text follows the figure for an explanation of each step.

Figure 3-3 Landline to Mobile with CFNA Interaction



Associated Call Flow Description:

(1) A landline phone originates a call. The processing to establish the voice path to the serving MSC is identical to the call flow in Figure 3-2 and is, therefore, not repeated here.

(2) The Serving MSC detects a No Answer (NA) condition and send a Redirection Request message to the Home MSC indicating the reason (NA) for the redirection request.

(3) The Home MSC sends a Transfer-to-Number Invoke to the subscriber's HLR and forwards the NA indicator. The HLR determines if the subscriber has the CFNA feature authorized and active. If the CFNA feature is authorized and active the HLR sends a Transfer-to-Number return result message back to the Home MSC with the CFNA destination digits included.

(4) The Home MSC sends a Redirection Request Return Result message to the Serving MSC, and the voice connection between the Home MSC and the S-MSC is released.

(5) The CFNA destination digits are analyzed in the Home MSC to determine if a query should be made on the destination digits. The query returns the LRN.

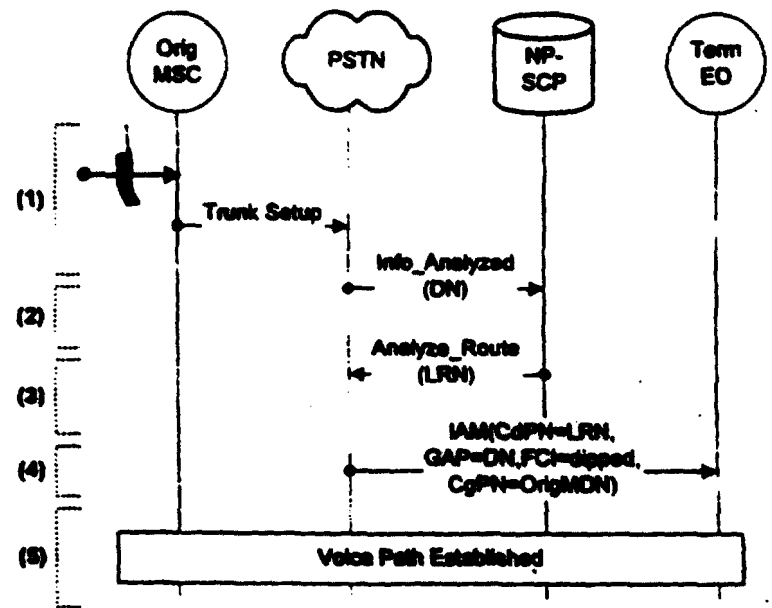
(6) The Home MSC formulates the IAM message with the CdPN equal to the LRN, the GA equal to the CFNA Destination Digits, and the FCI indicator to dipped.

(7) The call is completed with the new destination.

3.2.2.3 *The Mobile-to-Land Call*

Figure 3-4 illustrates a mobile to landline call in which the MSC is not the designated querying switch, i.e. a PSTN switch will perform the query. Figure 3-5 also illustrates a mobile to landline call, but in this case the MSC is the designated querying switch.

Figure 3-4 Mobile to Landline - PSTN Performs Query



Associated Call Flow Description:

(1) A mobile places a call, and the Originating MSC passes the call to the PSTN.

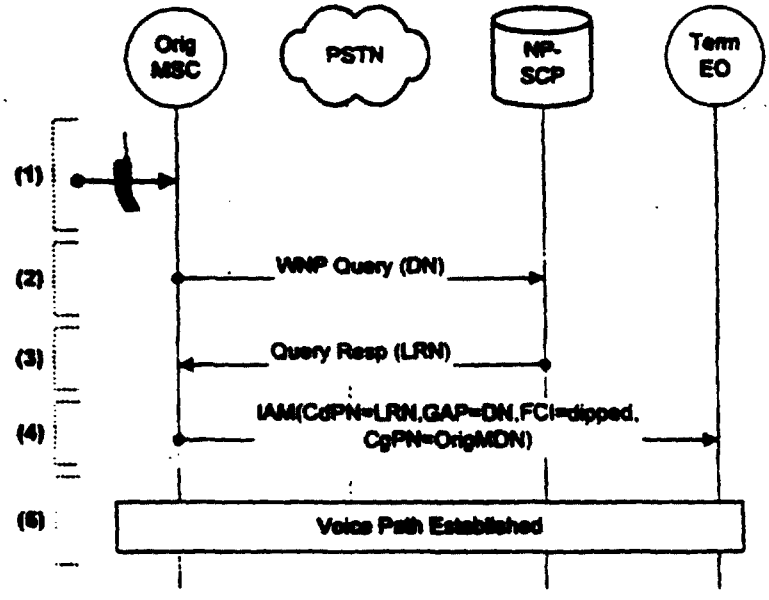
(2) The PSTN detects DN is within a portable block and launches a query to the NP-SCP with the landline DN.

(3) The NP-SCP returns the LRN for the DN.

(4) The PSTN formulates and sends the IAM message with the CdPN equal to the LRN, the GAP equal to the DN and the FCI mth bit set as queried to the terminating end office.

(5) The Terminating EO will complete the call to the loop to the assigned to the DN. The call is then connected.

Figure 3-5 Mobile to Landline - MSC Performs Query



Associated Call Flow Description:

(1) A mobile places a call

(2) The Originating MSC detects DN is within a portable block and launches a query to the NP-SCP with the landline DN.

(3) The NP-SCP returns the LRN for the DN.

(4) The MSC formulates and sends the IAM message with the CdPN equal to the LRN, the GAP equal to the DN and the FCI mth bit set as queried to the terminating end office.

(5) The Terminating EO will complete the call to the called DN.

3.2.2.4 The Mobile-to-Mobile Call

Figure 3-6 illustrates a mobile to mobile call in which the MSC is not the designated querying switch, i.e. a PSTN switch will perform the query. Figure 3-7 also illustrates a mobile to mobile call, but in this case the MSC is the designated querying switch. In fact, these figures illustrate that a concatenation of the previous figures (mobile originated and mobile terminated) produce expected results. This is an expected result because the originating and terminating MSCs are unaware of one another.

Therefore, no text is included beyond the figures for the sake of readability. Readers can infer the appropriate descriptions based on the previous call flows.

Figure 3-6 Mobile to Mobile - PSTN Performs Query

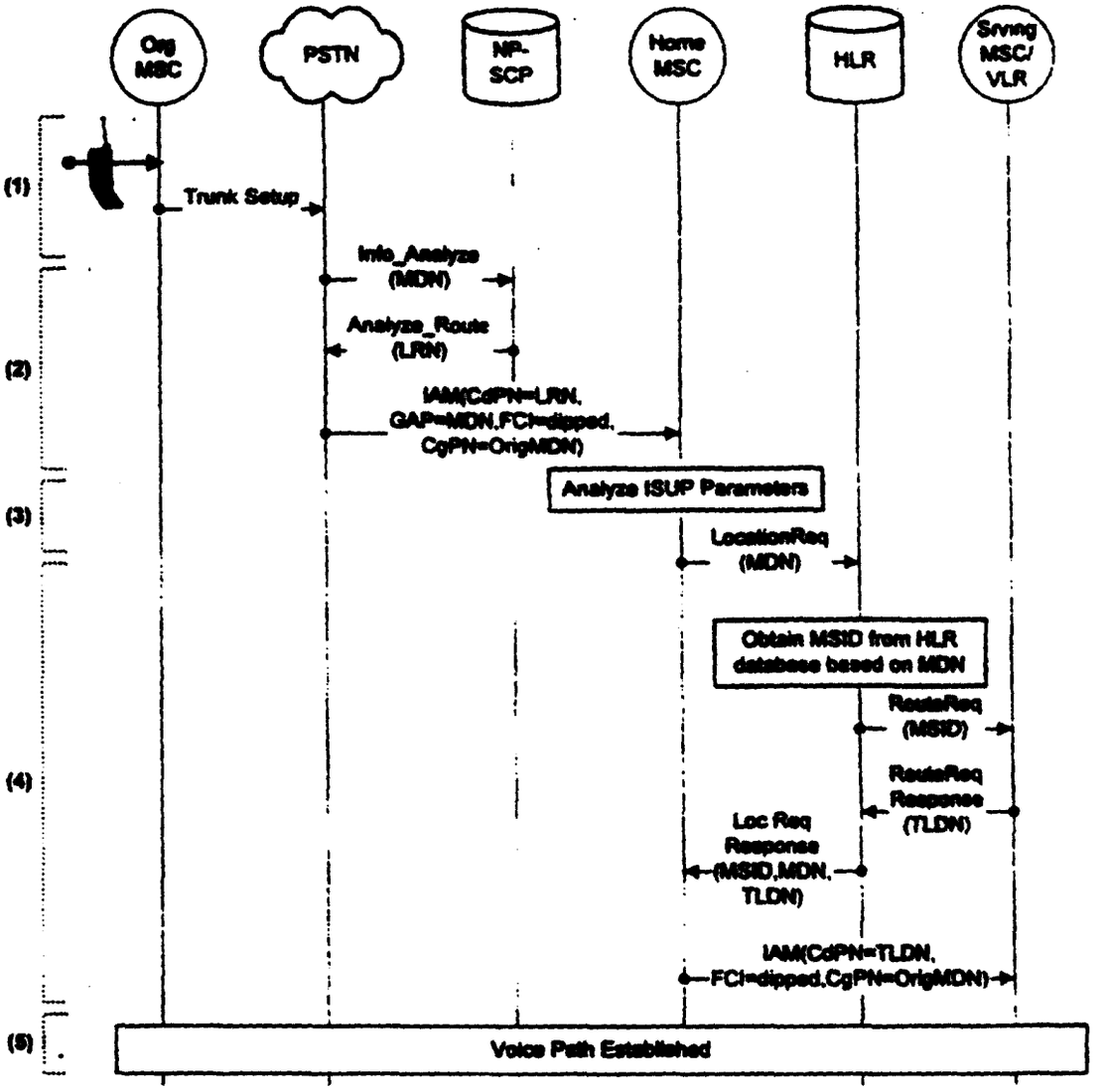
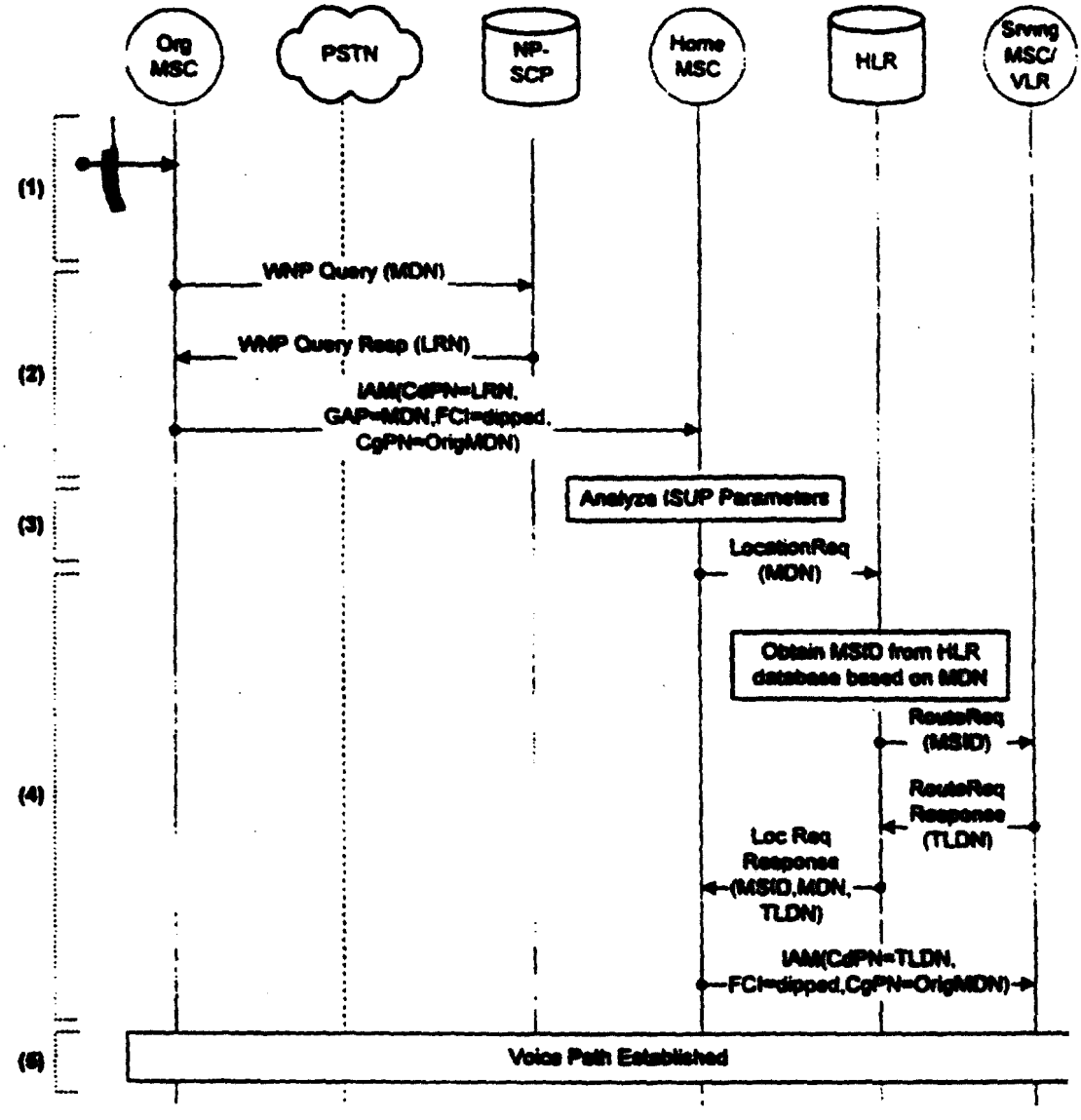


Figure 3-7 Mobile to Mobile - MSC Performs Query



3.3 *Feature Interactions*

This section describes the effect of WNP on the current base of wireless services.

3.3.1 *Operator Services*

An MSC can connect to an operator tandem switch in one of the three following ways:

- via a Type 1 connection to a local telephone company central office switch that interconnects with the operator tandem;
- via a Type 2D connection directly to the operator tandem; or
- via a Type 2A connection to an access tandem that interconnects with an inter-exchange carrier operator tandem using Feature Group D (FGD) signaling.

A mobile station dialing any of the following should route the call directly to the operator tandem where, if necessary, it will perform the query:

- 0-
- 00-
- 10xxx0-
- 101xxxx-0-
- 0-NPA-NXX-XXXX
- 10XXX-0-NPA-NXX-XXXX
- 101XXXX-0-NPA-NXX-XXXX

Existing ANI information transfer and AMA recording at the operator tandem will be sufficient to support WNP. However, the MSC must be modified to forward the MDN and not the MSID as the ANI digits.

3.3.2 *Roamer Access Port*

The Roamer Access Port service is one of several means of supporting call termination to roamers. Another feature of the Roamer Access Port is to allow the caller to directly be connected to the serving system, eliminating the call segment from the home system to the serving system.

Under the Roamer Access Port services, today, the caller dials a roamer access port number to reach the visited system and enters a roamer's MIN (as an MDN). When the MDN and MSID are separate, the serving system will also need to know the roamer's MSID.

3.3.3 *Emergency Services*

An MSC can connect to Emergency Services Providers (ESPs) in many ways. The current arrangements typically do not automatically forward the mobile station callback number to the ESP. For such arrangements, the ESP attendant must verbally request the callback number, if desired. FCC rules regarding emergency service calls from wireless systems dictate that by April 1, 1998, an MSC must automatically forward the mobile station callback number along with information identifying the cell site of call origin.

In any proposed configuration, the MDN must be provided to the ESP for callback purposes. The impact on the MSC with the WNP is such that the MSC must be modified to forward the MDN and not the MSID.

To meet the proposed April 1, 1998, FCC requirements, both the MF-FGD signaling and the SS7 ISUP (CPN) signaling arrangements may, in fact, be utilized. Therefore, the MSC must forward the MDN and not the MSID as the FGD ANI digits and must forward the MDN in the CPN parameter of the SS7 ISUP IAM message. This requirement applies to both home mobile stations and roaming mobile stations. Consequently, the MDN must be retrieved from the home system for any registered roaming mobile stations.

The impact of WNP with regard to Emergency Callback whether the call back is over a roamer access port or otherwise requires further study.

3.3.4 *Short Message Service*

3.3.4.1 *Impact of Number Portability*

Today, the recipient of a short message is identified by an MDN. The originating network uses the dialed MDN to route the short message to the destination home system. The dialed MDN is the same as the MIN or the first 6 digits of the dialed MDN are the same as the first 6 digits of the MIN if the MDN and MIN are separated. Typically, the first six digits of today's dialed MDN or MIN provide sufficient routing information for the short message to be delivered to the destination home system.

The wireless industry has decided to separate the MSID and the MDN to support WNP. As a result, Short Message Service (SMS) delivery is impacted. SMS will not operate properly as currently defined if the destination mobile station has ported its MDN. When the mobile station ports to another service provider, it is assigned a new MSID. The new MSID, particularly the first six digits, will identify the new service provider. However, when a short message is initiated to the ported mobile station, the calling party will only provide the MDN to the network. Since the destination MS has ported, the originating Short Message Entity (SME) or the SS7 network must analyze all the digits of the MDN to derive the necessary routing information to deliver the short message to the destination home system of the ported mobile station.

Five alternatives have been proposed to address the SMS routing problem in the WNP environment. In order to discuss and compare the alternatives, they must each address the following scenarios:

(a) Direct Routing to the Destination Home MC

If the short message need not go through the message originator's home MC, the short message is sent to the destination home MC directly from the originator's serving MSC. The case where a short message is sent from the originator's home MC to the destinatior home MC is covered under this scenario.

(b) Force Routing through the Message Originator's Home MC

If the SMS Origination Restriction of the originator indicates that the short message must be routed through the originator's home MC, the short message should be sent to the originator's home MC first.

(c) International Roaming

Each alternative must work if the short message is to be sent across the national boundaries (e.g., from the originator's serving MSC in one country to the destination home MC in another country).

Messages routing across national boundaries involves global title translations (GTTs) at the STPs in the national SS7 networks, originating and destination, and at the international gateway STPs in the international domain/level. This section focuses on messages required to be sent across the national boundaries and the translation types that may be required when a particular alternative is discussed.

3.3.4.2 Possible SMS Delivery Alternatives

The alternatives described in this section are to provide the industry with a starting point in addressing SMS impact in a WNP environment. The final solution(s) is for further study.

The descriptions of the alternatives below illustrate the successful delivery of a mobile originated short message to a ported MS. Also, these alternatives assume that the originating system is different from the destination system. Lastly, these alternatives are illustrated using IS-41 messaging protocol as an example.

The call flow procedures described below for each of the five alternatives are for scenario A as in the domestic domain. However, the discussion of the advantages and disadvantages of each alternative will cover scenarios A, B and C.

The following are for clarification in describing the alternatives: [30]

- Short Message Entity (SME) is a functional entity that composes and decomposes short messages. It may be located within and be indistinguishable from an MSC, HLR, VLR, MS, or MC.
- The message center (MC) is an entity that stores and forwards short messages. The MC may also provide supplementary services for SMS.

The following translation types have been identified in the forthcoming alternatives as potentially needed for routing short messages:

- MIN-to-MC translation. This translation type is existing, TT=12.
- IMSI-to-MC translation. This translation type is also existing, TT=13.
- MDN-to-MC translation. This translation type has not yet been defined.
- LRN-to-MC translation. This translation type has not yet been defined.
- MDN-to-NP-SCP translation. This translation type has not yet been defined. This translation type is needed in alternatives 2, 3 and 4 if the short message is to be delivered outside of the NPAC region.

SMS Alternative 1: SMS Forward to Serving Home MC

In alternative 1, an SMS Delivery Point to Point (SMDPP) message is first routed to the donor message center (MC). The donor MC then forwards the short message to the subscriber's home destination MC. The short message is routed to the donor MC by an MDN-to-(donor) MC translation via a 6-digit GTT at the STP or internal lookup table.

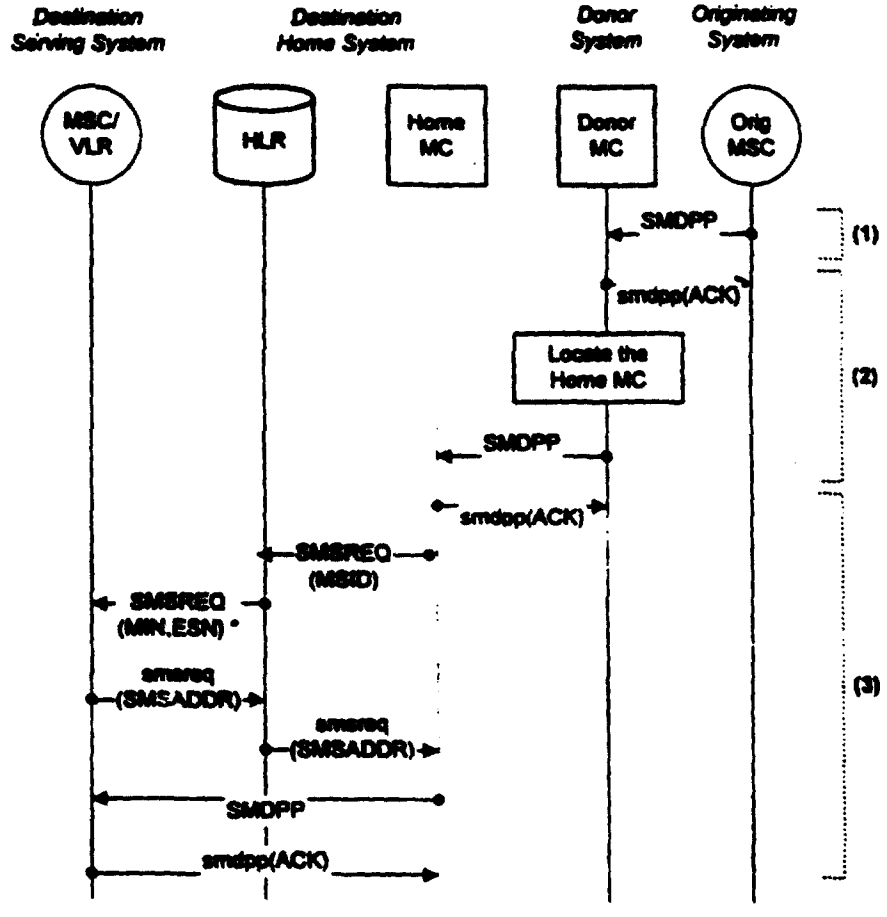
The donor MC locates the correct "serving" home MC of a ported subscriber by mapping the dialed MDN to its home MC (i.e., the translation is established via business arrangement). Then it forwards the message to the serving home MC. The donor MC may be the "original" home MC that serves the MDN before it is ever ported or may be an MC that provides an SMS forwarding service to "original" home systems that do not support SMS (e.g., third party donor MC or wants a third party to perform the forwarding function).

In the situation where the original system is a non-SMS capable system (i.e., had no MC), it is preferable for the third party donor MC to serves all the ported subscribers of the original system (within an NPA-NXX block). This will allow the preservation of 6-digit translation (e.g., 6-digit GTT at the STP) in routing short messages to the donor MC.

[30] The definitions are from IS-41, TIA/EIA SP 3588.1, Functional Overview, sections 5.1.6 and 5.1.10.

The following illustration along with the call flow procedures describes a successful short message delivery to a ported MS-based SME (i.e., terminating supplementary services):

Figure 3-8 Alternative 1 for SMS Delivery



* These messages are sent if the HLR does not have a current temporary SMS routing address

The detailed steps are as follows:

(1) The originating MSC routes the short message to the donor MC by performing an MI to-MC translation (i.e., via GTT at the STP or internal table).

If the subscriber has not been ported the donor MC is the subscriber's destination hor MC and should existing procedures to deliver the short message.

(2) When the donor home MC receives the SMDPP requesting delivery to a ported MS, it identifies the destination home MC of the ported MS by performing an MDN-to-MC lookup.

In the event that the donor MC is able to forward the SMDPP to the destination home MC or that it is the destination home MC, the donor MC responds to the originating system with an SMDPP positive acknowledgment.

If the MDN has not been ported out, the donor MC (which is the destination home MC delivers the message using existing procedures. In some instance, it may be more efficient for the donor MC to determine if it is the home MC before it uses the MDN-t MC lookup table.

In the ported MDN case, the donor MC forwards the short message to the destination home MC.

(3) When the destination home MC receives the SMDPP request, it delivers the short message following existing procedures.

If the donor MC is not able to forward the SMDPP to the destination home system because the donor MC fails to map the MDN to the destination home MC (e.g., there is no business arrangement or the SMDPP was routed to the donor MC in error), the donor MC responds to th originating system with an SMDPP negative acknowledgment with the SMS_CauseCode=1 fo address translation failure.

The advantages of Alternative 1 are as follows:

- It uses the 6-digit MDN-to-MC translation to get to the donor MC.
- There is no need to query the NP SCP. This is a cost saving for the carriers if they hav to pay for NP SCP queries.
- Wireless carriers may establish reciprocal business arrangement for the donor MC service.
- Short messages for MDNs that are not ported do not need to be forwarded.
- Short messages from other countries will be delivered to the donor MC using the MDI to-MC translation.
- There is no need for additional translation types. Thus, no need to pay for additional GTTs.

The disadvantages of Alternative 1 are as follows:

- Business arrangements with every donor MC or third party donor MC need to be established to ensure that SMS forwarding will be provided by the donor MC.
- The donor MC needs to maintain an MDN-to-"serving home" MC lookup table. The donor MC needs to be informed by the old service provider to terminate the message

forwarding service and by the new service provider requesting for the donor MC to forward the ported subscriber's messages to the new home MC. The new service provider will have to establish new business arrangement with the donor system while the old provider terminates its arrangement. This is a responsibility that the donor MC assumed because of its business arrangement. Thus, this function should be inherent to the business agreement.

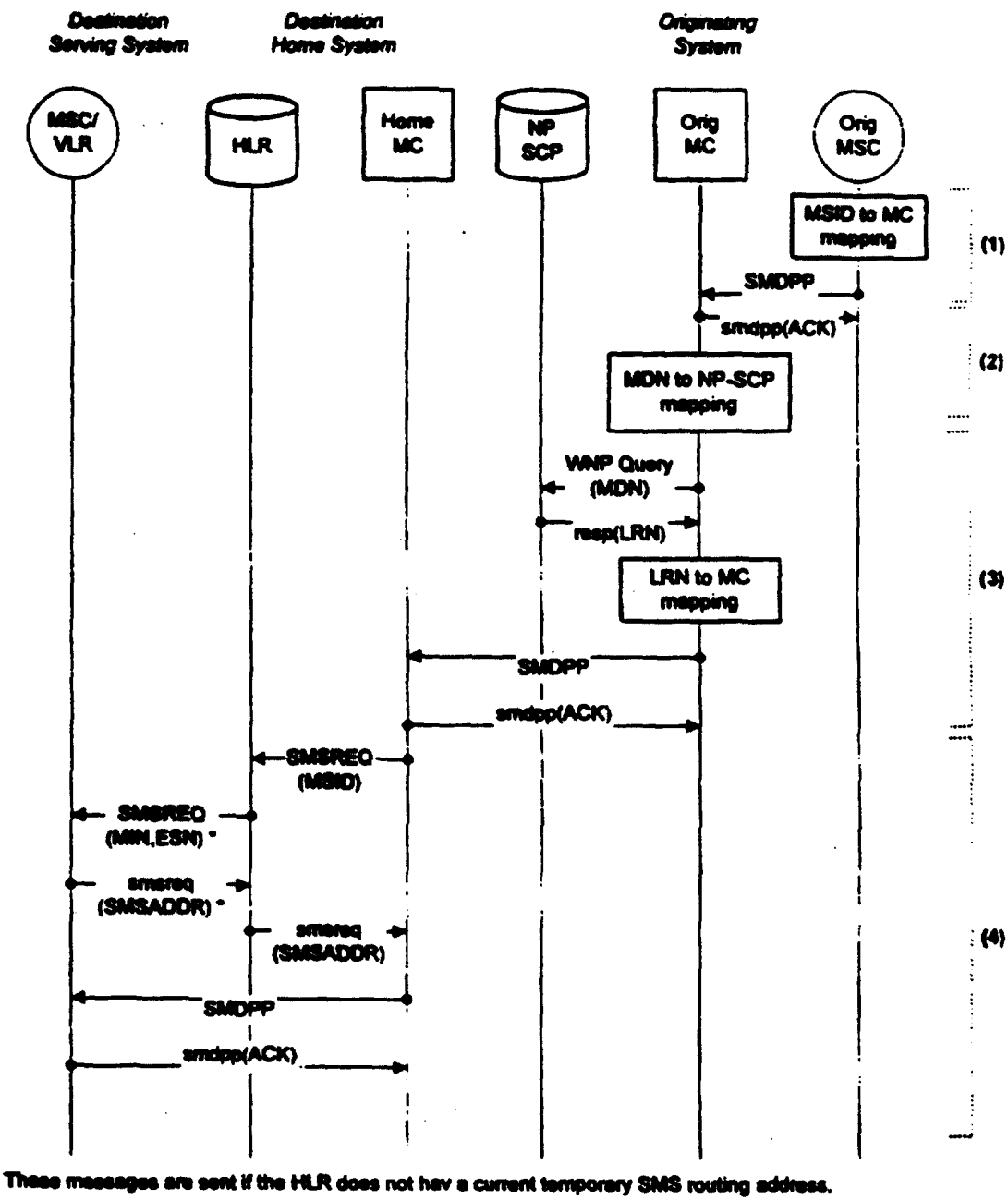
The following items with regard to Alternative 1 should be further investigated:

- Administration of the MDN-to-MC lookup table within the donor MC.

SMS Alternative 2: Message Center Query, LRN response to Originating MC.

In alternative 2, the short message is always sent to the originator's home MC based on the message originator's MSID (i.e., MSID-to-MC GTT at the STP or internal lookup table at the originating SME). When the originator's MC receives the SMDPP, it queries the NP SCP for th LRN associated with the dialed MDN. The short message is routed to the destination home MC using the LRN (i.e., LRN-to-MC GTT at the STP or internal lookup table at the originator's MC).

Figure 3-9 Alternative 2 for WNP SMS Delivery



* These messages are sent if the HLR does not hav a current temporary SMS routing address.

The detailed steps are as follows:

(1) The originator's MSC forwards the SMDPP to the originator's home MC using the MSID-to-MC translation via a 6-digit GTT at the STP or internal mapping.

(2) The originator's home MC retrieves the dialed MDN from the SMDPP message. It sends an IS-41 query message to the NP SCP through an STP. The STP performs an MDN-to-NP SCP GTT to identify the appropriated NP-SCP and forward the query message to that NP-SCP.

The NP-SCP maps the MDN to its associated LRN and responds with the LRN to the originator's home MC.

(3) Either an LRN-to-MC GTT translation is done at the STP or, using an internal table in the originator's home MC, the SMDPP message is routed to destination home MC.

(4) The destination home MC delivers the message using existing SMS procedures.

The advantages of Alternative 2 are as follows:

- The existing MSC-NP SCP interface can be used for the MDN-to-LRN translation to support SMS, although it is defined call routing.
- The NP SCP does not need to maintain additional routing information for SMS.

The disadvantages of Alternative 2 are as follows:

- The originator's home MC needs to have IS-41 query capability to query the NP-SCP.
- If multiple MCs serve the same MSC the network needs to support multiple LRNs per MSC or use one of the four digits of LRN for MC.
- New translation types are needed to support the MDN-to-NP SCP GTT (for inter-system) at the STP and the LRN-to-MC GTT at the originator's home MC or STP.
- Administration for the point code of MCs used for the LRN-to-MC GTT will be neede

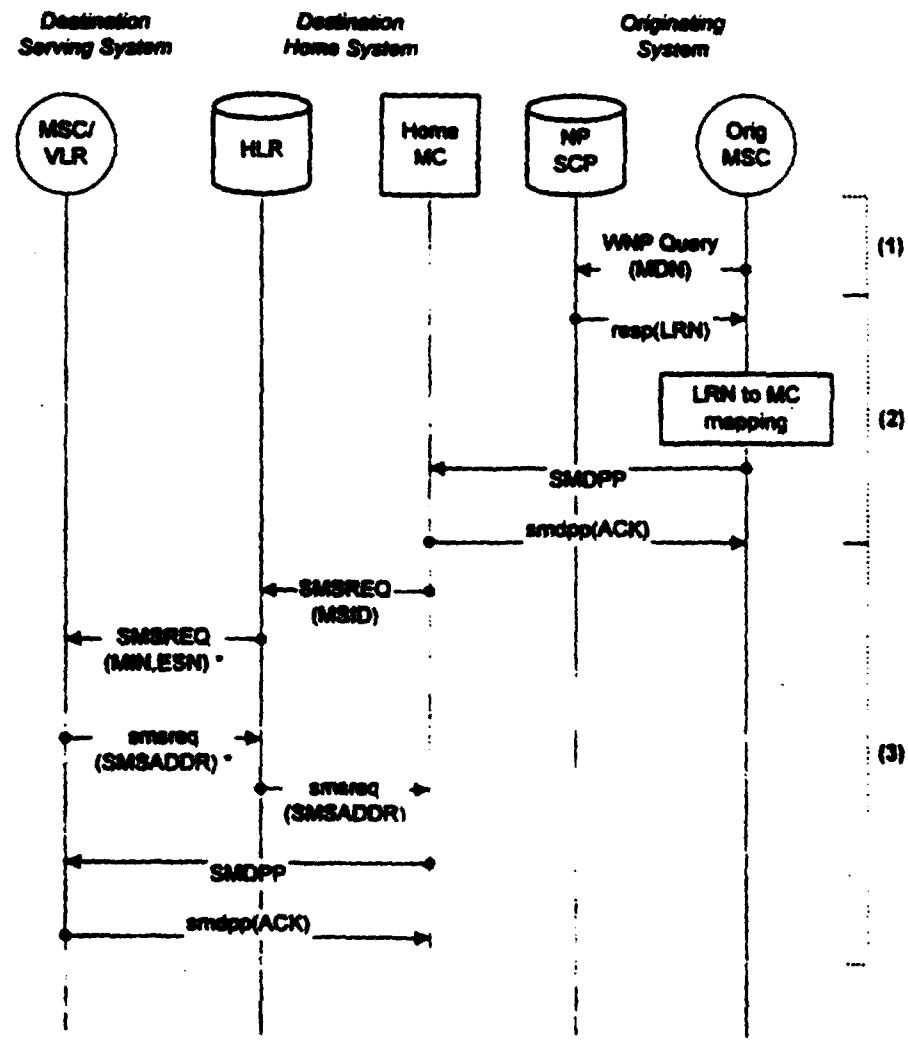
The following items with regard to Alternative 2 should be further investigated:

- In order to support international roaming, an originating system (i.e., originator's MC) that is in a foreign country needs to query the NP SCP for an LRN before the SMDPP can be routed to the destination home MC.
- Business arrangements will need to be established with remote NP SCP providers so tl queries can be targeted to the appropriate NP SCP with the necessary translation information.

SMS Alternative 3: MSC Query - LRN response to Originating MSC

In alternative 3, the originator's MSC queries the NP SCP for the LRN associated with the dial MDN. Then, the originator's MSC routes the short message to the destination home MC using the LRN (i.e., LRN-to-MC GTT at the STP or internal lookup table at the originator's MC).

Figure 3-10 Alternative 3 for SMS Delivery



* These messages are sent if the HLR does not hav a current temporary SMS routing address.

The detailed steps are as follows:

(1) The originator's MSC sends an IS-41 query message with the MDN to the NP-SCP through the STP. The STP performs an MDN-to-NP SCP GTT to determine the appropriate NP SCP to forward the query.

The NP-SCP maps the MDN to its associated LRN and responds with the LRN to the originator's MSC.

(2) Either an LRN-to-MC GTT is done at the STP or, using the internal table in the MSC. the SMDPP message is sent to the destination home MC.

(3) The destination home MC delivers the message using existing SMS procedures.

The advantages of Alternative 3 are as follows:

- The existing MSC-NP SCP interface can be used for the MDN-to-LRN translation to support SMS, although it is defined call routing.
- The NP SCP does not need to maintain additional routing information for SMS.

The disadvantages of Alternative 3 are as follows:

- The originator's MSC needs to query the NP-SCP.
- New translation types are needed to support the MDN-to-NP-SCP GTT at the STP and the LRN-to-MC GTT at the MSC or STP.
- Administration for the point code of MCs used for the LRN-to-MC GTT will be needed
- If force routing is invoked, the originator's MSC, after it receives the LRN from the NP SCP query response, needs to forward the LRN to the MC of the originating system. Enhancement to the IS-41 standard is needed.
- If multiple MCs serve one MSC. the network needs to support multiple LRNs or use one of the four digits of LRN for MC.

The following items with regard to Alternative 3 should be further investigated:

- In order to support international roaming, an originating system (i.e., originator's MSC that is in a foreign country needs to query the NP SCP for an LRN before the SMDPP can be routed to the destination home MC. This item needs further investigation.
- Business arrangements will need to established with remote NP SCP provider so that queries can be targeted to the appropriate NP SCP with the necessary translation information.